Can Monetary Incentives Improve Decision Making?

Senior Research Thesis

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by

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Abstract

Multiple studies of risky decision making have utilized monetary compensation for their participants. In most, participants are told at the start of the study that they will receive money or a gift card for their participation. There is currently no previous research into whether knowledge of a monetary incentive influences decision making on tasks that involve monetary rewards. However, if participants are told they will receive a portion of the monetary outcome from the task, and thus their compensation is linked to task performance, decision making is then affected. The present study sought to examine whether knowledge of a monetary incentive affects performance on decision making tasks. One hundred nine college student participants (26 males, ages 18-20) were recruited. During informed consent, 47 participants were told they would receive course credit and $10 for their participation, and the remaining participants were told about the course credit only. Participants then completed a series of computerized decision making tasks. Results indicated no between group differences on the decision making tasks. However, some significant correlations were found between the tasks themselves. Implications for decision making research are discussed.

Decision making, at the most basic and simple level, is the selection of one option from several alternatives (Seguin, Arseneault, & Tremblay, 2007). There are two types of decision making, "cold" and "hot." "Cold" decision making involves a rational and cognitive determination of risks and benefits associated with presented options (Seguin et al., 2007). "Hot" decision making instead involves the emotional and affective responses to the options presented (Seguin et al., 2007). Real-life situations in which individuals may use "cold" decision making techniques, taking into consideration the pros and cons of the situation, may be deciding on a new insurance company for a home or car. Situations in which individuals may use more "hot" decision making techniques, following their gut feeling or instincts, may be deciding on a new color to paint the living room of a home.

Decision making can be assessed with a variety of tasks in research and clinical settings. Although individuals could be asked to self-report how they would react to a given situation, utilizing behavioral decision making tasks provides a more valid means of assessing both hot and cold decision making processes (Lezak, Howieson, & Loving, 2004). Some of the most common measures of decision making include the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), Balloon Analogue Risk Task (BART; Lejuez et al., 2002), and the Game of Dice Task (GDT; Brand et al, 2005), all of which are thought to measure hot decision making. The Columbia Card Task (CCT; Figner, Mackinlay, Wilkening, & Weber, 2009) is versatile in that it can be potentially used to measure cold or hot decision making.

To date, many studies of decision making have used college student samples, in which students in introductory psychology courses are provided with course credit for research participation. However, researchers generally need to provide an alternative incentive for non-college student participants (e.g., Acheson & de Wit, 2008; Hopko et al., 2006). This typically

takes the form of a monetary incentive. Previous research investigating risky decision making on behavioral tasks in non-college students has typically paid participants (i.e., Bishara et al., 2009; Denburg et al., 2009; Lejuez et al., 2003), and the participants are told about this incentive when they sign up for the study—generally as part of the recruitment materials. However, does this prior knowledge in turn affect decision making task performance? To date, no research has directly examined this effect. We do know, however, that being told of the potential to receive a portion of the monetary outcome from the tasks can in turn change decision making (Coffey, Schumacher, Baschnagel, Hawk, & Holloman, 2011; Fein & Chang 2008; Hopko et al., 2006; Lejuez et al., 2002). It is possible that decision making performance may change, either towards a riskier or safer end, based on the potential to receive a portion of the money earned on the task. Yet, many studies provide a fixed monetary incentive, independent of decision making task performance, and it is uncertain what effect this could have on task performance.

The present study sought to expand on previous research by investigating whether participants' knowledge of a monetary incentive at the start of the study changes decision making task performance, in particular on tasks that utilize monetary reinforcers themselves. Although not studied in the decision making literature per se, social psychology researchers have investigated differences between standard college student participation and participants through Mechanical Turk (MTurk). No significant differences have been found between data collected through this pay for participation website versus non-paid student volunteers (e.g., Buhmester, Kwang, & Gosling, 2011; Casler, Bickel, & Hackett, 2013). Based on this related line of research, it was hypothesized that there will be no difference in decision making task performance between individuals who know in advance about the monetary incentive and those who did not know about the monetary incentive. It was also hypothesized that significant

correlations will be seen between performances on the measures of risky decision making, in that participants who are risky on one task will be risky on other tasks.

Methods

Participants

Participants consisted of 109 undergraduate students at The Ohio State University Newark, ages 18-20 (M = 18.18, SD = 0.44), who were enrolled in General Psychology courses. Interested participants could sign-up via an online system. Twenty-six participants were male, and 72% self-identified as Caucasian.

Measures

Positive and negative affect schedule (PANAS). The PANAS is a 20-item questionnaire that assesses two components of affect: positive and negative (Appendix A) (Watson, Clark, & Tellegen, 1988), and was administered to ensure mood did not affect decision making. Participants' responses can range from 1 (not at all) to 5 (very much), with higher average scores for each 10-item subtest indicating higher levels of positive or negative affect. Participants receiving high scores on the positive scale were likely feeling enthusiastic, alert, and full of energy (Watson et al, 1988). Participants receiving high scores on the negative scale were likely experiencing feelings of anger, contempt, disgust, and/or nervousness (Watson et al, 1988). Both the positive and negative subscales show high internal consistency, and 8-week test-retest reliability is moderate (Watson et al, 1988).

Iowa Gambling Task (IGT). The initial task was designed to measure decision making deficits in individuals with ventromedial prefrontal cortex damage but who showed no impairments on formal neuropsychological testing (Bechara et al., 1994). Participants are given a loan of $2000 at the start of the game and are told to maximize profit over 100 trials. Participants

then select from one of the four decks of cards: A, B, C, or D (Bechara, 2008). Decks A and B have a combined average profit of $100 per selection and Decks C and D have a combined average profit of $50 per selection (Bechara, 2008). After ten selections from Decks A or B, individuals have incurred an average loss of $250; however, after ten selections from Decks C or D individuals instead have earned an average gain of $250 (Bechara, 2008). From this observation, Decks A and B have been considered "disadvantageous" and Decks C and D "advantageous" (Bechara, 2008).

However, collapsing Decks A and B and Decks C and D misses important distinctions between each deck. Decks A and C result in losses on 50% of trials, and Decks B and D result in losses on only 10% of trials (Bechara, 2008). Thus, examining each deck individually allows for determination of focus on long-term versus short-term outcomes and frequency of wins/losses. In addition, previous research has shown that selections during the first 40 trials assess a different type of decision making than selections during the final 60 trials. The first set of selections is termed decision making under ambiguity, as selections are made without much knowledge about the relative risks/benefits of each deck (Brand, Recknor, Grabenhorst, & Bechara, 2007). The last trials, in which participants have enough experience to estimate the risks/benefits of each deck, are instead termed decision making under risk (Brand et al., 2007). Thus, in the present study, individual deck selections across the two blocks of trials (early, later) were examined. Evidence from previous research indicates the IGT assesses "hot" decision making processes, due to emotional processing that occurs prior to cognitive awareness (Buelow & Suhr, 2009). It should also be noted that impairments in cognitive skills that are part of "cold" decision making processes can also affect performance on the IGT (Buelow & Suhr, 2009; Busemeyer & Stout, 2002; Guillaume et al., 2009), indicating performance may blend both processes.

Balloon Analogue Risk Task (BART). The BART was created to assess risk-taking behavior in adolescents and adults (Lejuez et al., 2002). Participants see 30 balloons, one at a time, and are told to make money by pumping up the balloon. Each click, or pump, adds five cents to the temporary bank that holds the participants' earnings (Lejuez et al., 2002). However, balloons pop if they are pumped up too much. Each time the balloon pops, participants lose all of the money in the temporary bank and the next balloon appears (Lejuez et al., 2002). To bank the money, participants must press the "Collect $$$" button before the balloon pops and all the money in the temporary bank is transferred to the permanent bank (Lejuez et al., 2002). For this task, validity research has shown that the BART may measure risk taking that is significantly associated with self-reported measures designed to assess related constructs (Hunt, Hopko, Bare, Lejuez, & Robinson, 2005). According to an algorithm constructed by the task creators, the average breaking point for a balloon is 64 pumps (Lejuez et al, 2002). Balloons can pop at any time though, and participants do not know when each will pop. Risk taking behavior is rewarded to a level where further risk taking resulted in adverse outcomes, such as the explosion of a balloon and the loss of accrued money (Lejuez et al, 2002). For the present study, the average number of pumps adjusted for only the unexploded balloons was used at the outcome variable, with lower averages indicating safer decision making.

Columbia Card Task (CCT). The CCT is a computerized measure of risky decision making (Figner et al., 2009). Risk taking in the CCT is measured by the participants' voluntary stopping point in a series of small, increasingly risky choices. At the start of the CCT, there are four rows of eight cards each that are face down, and cards can be turned over as long as a gain card is encountered (Figner et al, 2009). When a loss card is instead encountered, the trial is terminated and the loss amount specified is then subtracted from the previous payoff. There are

two versions that assess different types of decision making: hot and cold. Only the cold version was administered in the present study. In this version, participants are asked to indicate the number of cards to be turned over, with no feedback provided regarding the success or failure of their strategy. There are 24 total trials, and the dependent variable utilized is the average number of cards chosen across trials (Figner et al, 2009).

Game of Dice Task (GDT). The GDT is a computerized measure of risk-taking behavior assessment that assesses decisions made under risky conditions (Brand et al., 2005). The GDT was designed to assess the possible influence of executive functions on decision making in a gambling-type situation. During the GDT, participants are asked to maximize their profit within 18 throws of a single virtual die (Brand et al., 2005). Before each throw, participants must choose a single number or combination of numbers (up to four numbers), with each choice tied to a specific gain/ loss amount. Choosing just one potential number can result in the most gain but also the most lost ($1000). Choosing a string of four potential numbers is the safest option, with a gain/loss amount of $200. Higher numbers of selections from each number of choices (1,2,3,4) are used to indicate greater (1,2) or lesser (3,4) risky decision making on this task (Brand et al., 2005).

Word Memory Test (WMT). The WMT is a computerized task designed to assess level of effort and engagement in cognitive testing (Green, 2003). On the WMT, individuals learn a series of 20 word pairs and then their memory for these word pairs is tested after a 30 minute delay. The word pairs are designed to be simple, such that even individuals with mild dementia can perform well on the task (Green, Lees-Haley, & Allen, 2002). In the present study, the WMT serves as a precautionary measure to check the participants' attention throughout the study.

Procedure

The present study was approved by the University's Institutional Review Board. The study manipulation occurred at the informed consent process. Some (n = 47) participants received a consent form indicating the incentive for their participation in the study was course credit and $10.00. In addition, to ensure participants knew the manipulation they were also read the following statement: "You will receive course credit as well as $10 for your participation". The remaining participants (n = 62) received a consent form indicating course credit as the only incentive for participation. After questions from the participant were answered, written informed consent was obtained. All participants then completed the PANAS to assess current mood, followed by the WMT, IGT, BART, CCT (cold), and GDT, presented in a counterbalanced order except for the WMT that was always presented first. At the end of the study, participants were debriefed on the study manipulation. All participants received the $10.00 incentive and course credit was assigned. Due to the nature of the study manipulation, all participants were asked to keep the specifics of the study confidential.

Data Analysis

Data were first examined for outliers and between-groups differences in demographic variables. Of note, some demographic data was lost due to computer malfunction. In addition, some participants failed to complete all decision making tasks due to time constraints. To test the first hypothesis, independent-samples t-tests were performed on the outcome variables for each of the decision making tasks and for the WMT, with the study condition (knowledge of the incentive, no knowledge of the incentive) as the independent variable. To test the second hypothesis, correlations were calculated between performance on each of the decision making tasks.

Results

Demographics

Study variables are presented in Table 1. There were no differences between the two groups in terms of gender, $\chi^2(N = 98) = 0.04$, $p = .83$; age, $t(94) = -0.50$, $p = .62$; ethnicity, $\chi^2(N = 95) = 9.54$, $p = .09$, positive mood, $t(76) = 1.35$, $p = .18$; or negative mood, $t(76) = 0.28$, $p = .78$. Additionally, there were no group differences found in performance on the WMT initial recognition, $t(46) = -0.22$, $p = .83$ or delayed recognition, $t(23) = 0.76$, $p = .46$. Thus, there was no difference between groups in effort in and engagement with the cognitive tasks.

Testing the Hypotheses

There were no group differences found in performance on the CCT cold condition, $t(101) = -1.87$, $p = .07$ (see Table 1). Also, there were no group differences found in performance on the BART, $t(108) = -0.09$, $p = .93$. There were no group differences found in performance (total money earned) on the GDT, $t(81) = -1.46$, $p = .15$. There were also no group differences found in performance on the IGT among the early trials: A: $t(108) = -1.03$, $p = .30$, B: $t(108) = 1.10$, $p = .28$, C: $t(108) = -1.22$, $p = .23$, D: $t(108) = 0.60$, $p = .56$. Results showed no group differences in performance among the later IGT trials either: A: $t(108) = -1.26$, $p = .21$, B: $t(108) = .07$, $p = .95$, C: $t(108) = -0.44$, $p = .66$, D: $t(108) = 0.54$, $p = .59$.

Next, correlations were examined between the behavioral decision making tasks (see Table 2). Significant correlations were found between IGT variables. Among the early trials only, Deck B was negatively correlated with Decks A and C (ps < .001). Deck D was significantly and negatively correlated with selections from the other decks (all ps < .001). Correlations were also found among deck selections on the later IGT trials. Specifically, selections from Deck B were negatively correlated with selections from Decks C and D (ps <

.001), and selections from Deck C were negatively correlated with selections from Deck D ($p <$ .001). Thus, participants learned to select from the "best" deck and avoid the riskier decks.

One correlation emerged between the BART and IGT. Specifically there was a significant negative correlation between the average adjusted pumps and early deck B selections, $p < .05$. This correlation is a little confusing, as increased risk taking on the BART is associated with decreased risk taking on the IGT. However, this occurred during early trials only when participants did not know much about the decks.

Significant correlations were found between CCT variables and other decision making task variables. In particular, the CCT was found to negatively correlate with Deck D selections on the later trials ($p < .05$).

Significant correlations were found between GDT variables and other decision making tasks. The GDT was found to positively correlate with the CCT ($p < .05$). Selections of two options on the GDT was found to positively correlate with Deck C in the IGT later trials ($p <$ .05). Selections of four options was negatively correlated with Deck C in the IGT later trials ($p <$ .01).

Discussion

The present study had two goals: to examine the effect of knowledge of a monetary incentive on task performance and to examine correlations between decision making tasks. The first hypothesis was that there would be no difference in decision making task performance between individuals who knew in advance about a monetary incentive and those who did not know in advance about a monetary incentive. This hypothesis was supported. Specifically, the results indicated no between group differences on any of the decision making tasks. To date, no previous research has examined whether advance knowledge of a monetary reinforcer (a set

amount) affects decision making, especially when the decision making tasks involve monetary reinforcers themselves. The present null finding is important as it shows there is no difference in decision making processes when a monetary incentive is presented to participants. This lack of a difference indicates that we can consolidate results of studies across participant types (Bishara et al., 2009; Denburg et al., 2009; Lejuez et al., 2003). Thus, a study of personality characteristics pertaining to college students can be generalized to non-college students, and vice versa. That said, linking monetary outcome from the tasks with a monetary incentive does affect decision making (Coffey et al, 2011; Fein & Chang, 2008; Hopko et al., 2006; Lejuez et al., 2002). However, relatively fewer studies link incentives with task performance in comparison to providing a set incentive amount.

The second hypothesis was that significant correlations would be seen between the decision making tasks, as previous research has been inconclusive (e.g., Buelow & Blaine, 2014; Buelow & Suhr, 2009; Brand et al., 2005; Lejuez et al., 2003). The present results indicated correlations between early Deck B selections on the IGT and performance on the BART; however, the results indicated that individuals who selected more from Deck B (a risky deck) were less risky on the BART. This finding is counterintuitive, and the lack of correlations on the later IGT trials (decision making under risk) indicate this may be a consequence of the ambiguous nature of the early IGT trials. Previous research has shown few correlations between the IGT and BART (e.g., Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Buelow & Blaine, 2014; Lejuez et al., 2003), yet both are thought to measure hot decision making processes. Riskier performance on the CCT was associated with fewer Deck D selections on the later IGT trials. Only one study has previously compared the IGT and CCT (Buelow & Blaine, 2014), finding no relationship between the two tasks. In addition, the CCT-cold was utilized in the

present study, whereas the IGT is thought to assess more hot decision making. That said, cognitive components do also have a role in decision making on the IGT (Brand et al., 2007; Busemeyer & Stout, 2002; Guillaume et al., 2009).

Correlations were also found between the GDT and both the CCT and IGT. The GDT is a relatively new measure of decision making, and only previously has been compared to the IGT with mixed findings (Brand et al. 2005; Brand et al., 2007). The present results show that riskier decisions on the GDT are associated with risker decisions on the CCT-cold, as well as with fewer later Deck C selections on the IGT. Taken together, the current results indicate preliminary evidence that these tasks measure the same underlying construct of decision making, though the extent of hot versus cold decision making processes involved is unknown. However, additional research is needed to truly determine discriminant and convergent validity for the tasks.

Limitations

There were several limitations to the present study. Age range of participants was one potential limitation, as it is possible that results could be different with older participants who are more financially stable. However, using a limited age range limits any age-related effects on the results (but limits generalizability). Gender of participants was another potential limitation, as there were only 26 males who completed the study. Previous research about gender differences in decision making is inconsistent, and so the effect of gender on the results is uncertain. Data was not collected on previous gambling history. We were, though, able to determine if participants had seen the decision making tasks before (no one had). One significant potential limitation is the presence of crosstalk about the monetary incentive manipulation. Specifically, it is uncertain to what extent participants knew prior to the study session about the monetary incentive utilized. During the debriefing process participants were asked to keep specifics of the

study confidential. An end-of-study questionnaire was also administered at the end of each session that asked what participants had heard about the study in advance. Examining these responses indicated two potential instances of crosstalk (participants indicated knowing of the monetary incentive and that there was a study manipulation); however, both participants with this knowledge were in the advance knowledge condition as well, and it should not have affected the results. Finally, one other limitation was that we were unable to offer a complete control condition in which no money or course credit was assigned. This may be a difficult manipulation to investigate, but it would allow for knowledge of the effects of any reinforcement on decision making task performance.

Conclusions and Future Directions

In conclusion, knowledge of a monetary incentive has no effect on decision making as long as it is not tied to total performance on the decision making tasks. This means that information gained from studies of all types of participants (students and non-students) can be combined to understand factors affecting decision making more generally. Future research should continue to provide monetary incentives (that are not linked to task performance) to non-student participants, as task performance is equivalent when no monetary incentive is used. Future research should ensure no gender or age differences, and to find more effective means by which crosstalk can be decreased if not eliminated entirely. The decision making tasks were not as strongly correlated with one another as they should be if all measure the same underlying components of decision making, indicating the need for multiple measures of decision making in a given study and further understanding of what each task measures.

References

Acheson, A., & de Wit, H. (2008). Bupropion improves attention but does not affect impulsive behavior in healthy young adults. *Experimental and Clinical Psychopharmacology, 16*, 113-123.

Aklin, W.M., Lejuez, C.W., Zvolensky, M.J., Kahler, C.W., & Gwadz, M. (2005). Evaluation of behavioral measures of risk taking propensity with inner city adolescents. *Behaviour Research and Therapy, 43*, 215-228.

Bechara, A., Damasio, A.R., Damasio, H., & Anderson, S.W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition, 50*, 7-15.

Bishara, A.J., Pleskac, T.J., Fridberg, D.J., Yechiam, E., Lucas, J., Busemeyer, J.R., . . . & Stout, J.C. (2009). Similar processes despite divergent behavior in two commonly used measures of risky decision making. *Journal of Behavioral Decision Making, 22*, 435-454.

Brand, M., Recknor, E.C., Grabenhorst, F., & Bechara, A. (2007). Decisions under ambiguity and decisions under risk: Correlations with executive functions and comparisons of two different gambling tasks with implicit and explicit rules. *Journal of Clinical and Experimental Neuropsychology, 19*, 86-99.

Brand, M., Fujiwara, E., Borsutzky, S., Kalbe, E., Kessler, J., & Markowitsch, H.J. (2005). Decision-making deficits of Korsakoff patients in a new gambling task with explicit rules: Associations with executive functions. *Neuropsychology, 19*, 267-277.

Buelow, M.T., & Blaine, A. (2014). Is it hot or cold decision making? A factor analysis of performance on the Iowa gambling task, balloon analogue risk task, and Columbia card task. Manuscript under review.

Buelow, M.T., & Suhr, J.A. (2009). Construct validity of the Iowa gambling task. *Neuropsychology Review*, *19*, 102-114.

Buhrmester, M., Kwang, T., & Gosling, S.D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 8*, 3-5.

Busemeyer, J.R., & Stout, J.C. (2002). A contribution of cognitive decision models to clinical assessment: Decomposing performance on the Bechara gambling task. *Psychological Assessment*, *14*, 253-262.

Casler, K., Bickel, L., & Hackett, E. (2013). Separate but equal? A comparison of participants and data gathered via Amazon's MTurk, social media, and face-to-face behavioral testing. *Computers in Human Behavior, 29*, 2156-2160.

Coffey, S.F., Schumacher, J.A., Baschnagel, J.S., Hawk, L.W., & Holloman, G. (2011). Impulsivity and risk-taking in borderline personality disorder with and without substance use disorders. *Personality Disorders: Theory, Research, and Treatment*, *2*, 128-141.

Denburg, N.L., Weller, J.A., Yamada, T.H., Shivapour, D.M., Kaup, A.R., …, & Bechara, A. (2009). Poor decision making among older adults is related to elevated levesl of neuroticism. *Annals of Behavioral Medicine*, *37*, 164-172.

Fein, G. & Chang, M. (2008). Smaller feedback ERN amplitudes during the BART are associated with greater family history density of alcohol problems in treatment-naïve alcoholics. *Drug and Alcohol Dependence*, *92*, 141-148.

Figner, B., Mackinlay, R.J., Wilkening, F., & Weber, E.U. (2009). Affective and deliberative processes in risky choice: Age differences in risk taking in the Columbia card task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*, 700-730.

Green, P., Lees-Haley, P.R., & Allen III, L.M. (2002). The word memory test and the validity of neuropsychological test scores. *Journal of Forensic Neuropsychology, 2*, 97-124.

Green, P. (2003). *Word memory test for windows: User's manual and program*. Edmonton, Canada: Green's Publishing.

Guillaume, S., Jollant, F., Jauseent, I., Lawrence, N., Malafosse, A., & Courtet, P. (2009). Somatic markers and explicit knowledge are both involved in decision making. *Neuropsychologia, 47*, 2120-2124.

Hopko, D.R., Lejuez, C.W., Daughters, S.B., Aklin, W.M., Osborne, A., …, & Strong, D.R. (2006). Construct validity of the balloon analogue risk task (BART): Relationship with MDMA use by inner-city drug users in residential treatment. *Journal of Psychopathology and Behavioral Assessment*, *28*, 95-101.

Hunt, M.K., Hopko, D.R., Bare, R., Lejuez, C.W., & Robinson, E.V. (2005). Construct validity of the balloon analog risk task (BART): Associations with psychopathy and impulsivity. *Assessment*, *12*, 416-428.

Lejuez, C.W., Read, J.P., Kahler, C.W., Richards, J.B., Ramsey, S.E., . . . & Brown, R.A. (2002). Evaluation of a behavioral measure of risk taking: The balloon analogue risk task (BART). *Journal of Experimental Psychology: Applied, 8*, 75-84.

Lejuez, C.W., Aklin, W.M., Jones, H.A., Strong, D.R., Richards, J.B., …, & Read, J.P. (2003). The balloon analogue risk task (BART) differentiates smokers and nonsmokers. *Experimental and Clinical Psychopharmacology*, *11*, 26-33.

Lezak, M.D., Howieson, D.B., & Loving, D.W. (2004). Neuropsychological Assessment. New York, New York: Oxford.

Seguin, J.R., Arseneault, L., & Tremblay, R.E. (2007). The contribution of "cool" and "hot" components of decision-making in adolescence: Implications for developmental psychopathology. *Cognitive Development*, *22*, 530-543.

Xiao, L., Bechara, A., Cen, S., Grenard, J.L., Stacy, A.W., …, &Johnson, A. (2008). Affective decision-making deficits, linked to a dysfunctional ventromedial prefrontal cortex, revealed in 10th grade Chinese adolescent smokers. *Nicotine and Tobacco Research, 10*, 1085-1097.

Watson, D., Clark, L.A., & Tellegen, A. (1988). Developmental and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070.

Table 1.

Study Variables Presented as Mean (Standard Deviation)

Variable	Advance	No Advance	*t*	*p*
n	47	62		
Age	18.15 (0.44)	18.19 (0.44)	-0.50	.62
Gender	10 males	16 males		
PANAS: Positive	3.07 (0.61)	2.87 (0.72)	1.35	.18
PANAS: Negative	1.44 (0.43)	1.40 (0.52)	0.28	.78
WMT: IR	98.63 (2.62)	98.86 (1.07)	-0.22	.83
WMT: DR	98.83 (2.31)	97.50 (3.54)	0.76	.46
IGT				
A 1	20.10 (6.19)	21.22 (5.20)	-1.04	.30
B 1	33.01 (8.52)	31.15 (9.12)	1.10	.28
C 1	21.20 (5.23)	22.62 (6.90)	-1.22	.23
D 1	25.70 (9.22)	24.60 (9.62)	.592	.56
A 2	13.13 (7.63)	14.92 (7.18)	-1.26	.21
B 2	32.31 (18.40)	32.10 (14.90)	0.07	.95
C 2	22.24 (16.10)	23.58 (15.30)	-0.44	.66
D 2	31.21 (18.88)	29.40 (16.45)	0.534	.59
BART-NA	29.41 (13.14)	29.64 (12.75)	-0.09	.93
CCT-C	10.00 (4.80)	11.82 (5.00)	-1.87	.07
GDT	-2397.62 (3400.75)	-1358.54 (3083.26)	-1.46	.15
$ Earned				

Select 1	3.90 (4.05)	3.49 (3.44)	0.51	.61
Select 2	2.84 (2.62)	3.29 (2.43)	-0.85	.40
Select 3	4.51 (3.38)	4.00 (2.56)	0.79	.43
Select 4	6.75 (4.27)	7.22 (4.38)	-0.51	.61

*$p < .05$

Note: PANAS = Positive and Negative Affect Schedule; WMT = Word Memory Test, Immediate Recall (IR) and Delayed Recall (DR); IGT = Iowa Gambling Task, percent selections from each deck on the early (1) and later (2) trials; BART = Balloon Analogue Risk Task, number of average pumps per balloon; CCT = Columbia Card Task, average number of selections per trial; GDT = Game of Dice Task, total money earned ($), number of selections from each of the four series of options.

Table 2.

Correlations between Decision Making Tasks

Variable	1	2	3	4	5
1. IGT A1	--				
2. IGT B1	**-.42*****	--			
3. IGT C1	.12	**-.26****	--		
4. IGT D1	**-.32*****	**-.47*****	**-.52*****	--	
5. IGT A2	**.31*****	-.13	.13	-.12	--
6. IGT B2	-.11	**.27****	-.17	-.09	-.05
7. IGT C2	.01	-.05	**.29****	-.15	-.02
8. IGT D2	-.03	-.16	-.14	**.25****	**-.34*****
9. BART	.12	**-.19***	.05	.04	.02
10. CCT	.12	-.01	-.03	-.05	.02
11. GDT-$	.05	.06	.08	-.13	-.01
12. GDT-1	.01	-.07	-.10	.12	.10
13. GDT-2	-.18	.04	.06	.03	**-.25***
14. GDT-3	-.02	.04	-.05	.02	-.06
15. GDT-4	.11	.01	.08	-.14	.11

*$p < .05$; **$p < .01$; ***$p < .001$.

Note: IGT = Iowa Gambling Task, percent selections from each deck on the early (1) and later (2) trials; BART = Balloon Analogue Risk Task, number of average pumps per balloon; CCT = Columbia Card Task, average number of selections per trial; GDT = Game of Dice Task, total money earned ($), number of selections from each of the four series of options.

Table 2. (cont)

Variable	6	7	8	9	10
1. IGT A1					
2. IGT B1					
3. IGT C1					
4. IGT D1					
5. IGT A2					
6. IGT B2	--				
7. IGT C2	**-.47*****	--			
8. IGT D2	**-.46*****	**-.43*****	--		
9. BART	.06	.00	-.12	--	
10. CCT	.13	.10	**-.22***	.13	--
11. GDT-$	.01	-.00	-.00	-.01	-.15
12. GDT-1	-.00	.00	-.04	.09	**.22***
13. GDT-2	.09	**.22***	-.16	.00	-.06
14. GDT-3	-.05	.20	-.09	.16	.03
15. GDT-4	-.02	**-.27****	.19	-.19	-.17

Table 2. (cont)

Variable	11	12	13	14	15
1. IGT A1					
2. IGT B1					
3. IGT C1					
4. IGT D1					
5. IGT A2					
6. IGT B2					
7. IGT C2					
8. IGT D2					
9. BART					
10. CCT					
11. GDT-$	--				
12. GDT-1	**-.86*****	--			
13. GDT-2	-.01	-.08	--		
14. GDT-3	**.36*****	**-.41*****	-.04	--	
15. GDT-4	**.50*****	**-.55*****	**-.50*****	**-.33****	--

Appendix A

Positive and Negative Affect Schedule

Directions: This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate answer next to the word. Indicate to what extent you feel this way **right now**.

	Very Slightly	A Little	Moderately	Quite a Bit	Extremely
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5